

UK Patent Application GB 2 395 731 A

(12) Date of A Publication 02.06.2004

(21) Application No:	0327516.1	(51) INT CL ⁷ : E04C 2/28
(22) Date of Filing:	26.11.2003	(52) UK CL (Edition W): E1D DCF D1073 D2145 D402 D406 D547
(30) Priority Data:		(56) Documents Cited: GB 2229465 A
(31) 0227564	(32) 26.11.2002	(33) GB
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(54) Abstract Title: **Interior wall panel for building**

(57) A wall panel comprises a frame of interconnected cold formed metal members 1, a mesh 10 secured to one face of the frame, on top of which is a surface layer of set self levelled hydraulic material 20, at least part of which is formed in situ. Fittings 5 may be applied to the frame during formation, and a vertical boundary, e.g. fixed by bolts 15, may be used as a temporary mould. The frame may be of steel, and the settable composition may be an anhydrite or gypsum or cement based composition, and have a preformed portion 5 set into it. The mesh may be secured to the frame using ballistic bolts, and a breather or moisture - resistant membrane may be interposed between the frame and the mesh. Methods of forming such a panel are disclosed.

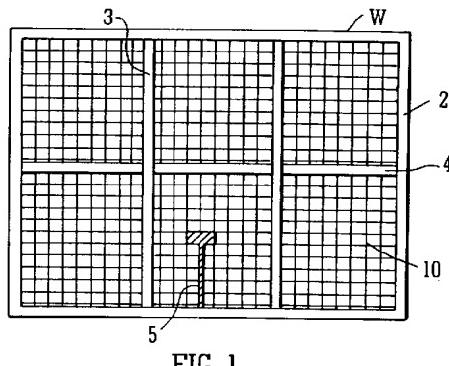


FIG. 1

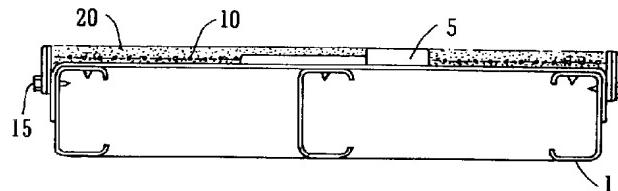


FIG. 3

1/2

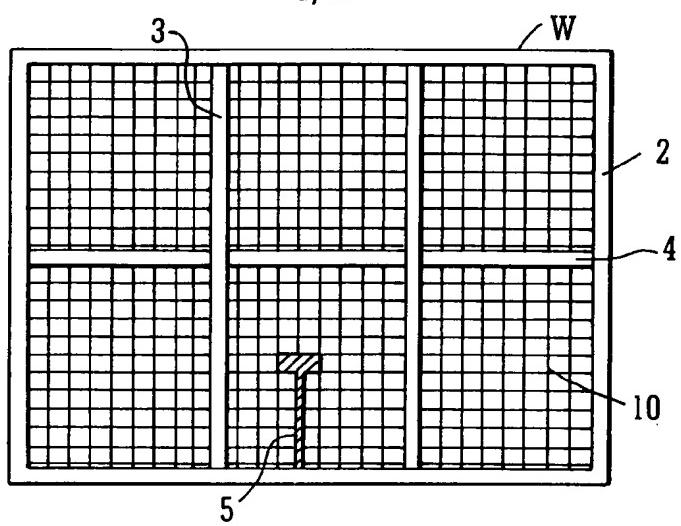


FIG. 1

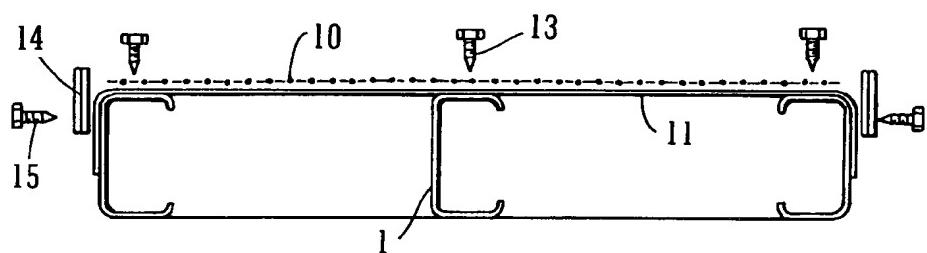


FIG. 2

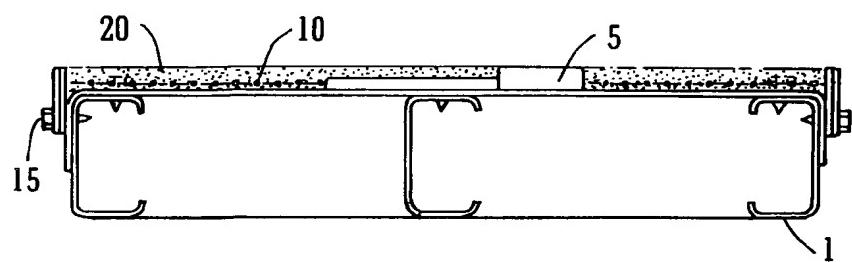


FIG. 3

2/2

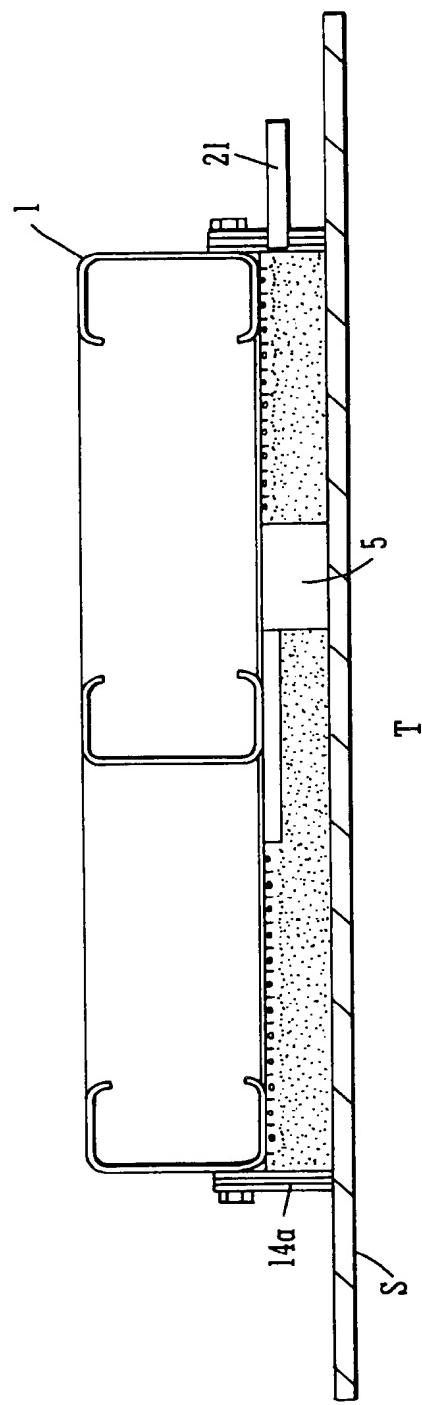


FIG. 4

BUILDING

The invention relates to buildings, and in particular to panels which may be assembled into modules to form single or multi-storey buildings. More particularly, the invention is concerned with panels having cold formed metal frames, made up of side members and vertical and horizontal reinforcing bars.

It is known from US patents 3604174 and 3760540 that concrete or lightweight concrete can be poured into a mould which is a metal frame to form a panel. The metal frame protects the set concrete and can be used to join one panel to another to form a wall of a building. Finishes may be applied to the concrete face. In US 3604170 the concrete face is the intended exterior face of a building. In US 3760540 the concrete is not intended to be exposed because a final finish is applied.

It is known that there are advantages in making a building having a metal frame because the metal can be made accurately and consistently. The jobs of making the components and assembling them can be deskilled, so reducing labour costs without compromising quality and accuracy. The wall is erected of the metal frame. A layer of a surface material is applied on site to form the inner surface of the room or other inner space and typically this is a preformed plasterboard or the like.

It is an object of this invention to advance this technology, in particular by simplifying and accelerating the formation of wall panels which can be used to make e.g. multi-storey structures.

The invention is based on the realisation that a defined metal frame forming the outer perimeter of a wall panel may be used as a mould for a settable composition to form a room inner layer, so avoiding the need to later apply a preformed plasterboard or the like.

In one aspect the invention provides a wall panel comprising a frame formed of interconnected structural cold formed metal members, a mesh secured to one face of the frame, on top of which is a surface layer of set self levelled hydraulic material, at least part of which was formed in situ.

Typically the metal frame is made of cold formed steel structural members of channel section.

The set layer is formed of a hydraulically self levelling settable composition. Anhydrite, gypsum and cement based compositions are preferred. The layer is preferably formed completely of the material set in situ but it is also within the scope of the invention to include preformed portions which are secured in place using the set composition.

The mesh is secured to the cold formed metal frame using ballistic nails or like securing means. A moisture resistant membrane, e.g. breather membrane, may be interposed between the edge of the frame and the mesh to prevent the escape of setting material through the mesh.

In another aspect the invention provides a method of making a building wall panel, the method comprising:

- forming a frame comprising interconnected elongate structural cold formed metal members;
- lying the frame on its face with the cavity side uppermost;
- securing a mesh to the upper face of the frame;
- applying fittings at the intended locations to the mesh upper face of the frame;
- forming a vertical boundary about the perimeter of the frame;
- supplying a self-setting self levelling composition within the boundary and allowing or causing it to set; and
- removing the boundary.

The boundary is intended to prevent escape of the self-setting composition while it sets. In addition it may be used to form a profile to the edge of the formed surface layer.

In yet another aspect the invention provides a method of making a building wall panel, the method comprising:

- forming a frame comprising interconnected structural cold formed metal members;
- applying a mesh to the lower surface of the frame;
- applying fittings at the intended locations to the mesh;
- locating the frame with the cavity side lowermost over a substrate and within a boundary wall;
- pumping a self-setting composition between the substrate and the mesh within the boundary wall;
- allowing composition to set; and

- uprighting the frame.

In yet another aspect the invention provides a method of making a building panel wall as defined above, comprising the step of including a preformed body within the boundary or within the frame as appropriate and then adding the self-setting composition to secure the body in place and to form the layer incorporating that body.

Extra layers may be added before or after the mesh; an example is a moisture resistant membrane.

A wall of a building has an outer skin and an inner one. The invention is particularly applicable to panels which will provide the inner skin. The outer skin, which may be brick, cladding or timber may be joined to an inner skin of the invention in known manner.

The self-setting composition is hydraulically settable and incorporates ingredients so that it will be self-levelling. The rate of set may be controlled using suitable accelerators and retarders. The composition may be anhydrite, gypsum or cementitious based. By judicious selection of the composition and additives the mechanical, thermal and acoustic properties may be chosen with ease.

Typically the set composition will define the face of the panel and it will be unnecessary to cover it with another layer but of course this can be done, e.g. a paint finish may be applied.

In order that the invention may be well understood it will now be described by way of example only with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is an elevation of a box comprising panels of the invention from the cavity side of a wall;

Figure 2 is a side elevation of a panel frame on its face about to be provided with a surface layer;

Figure 3 is a view as Figure 2 at a later stage;

Figure 4 is a view of a panel of the invention at a stage of infill in another method of providing the surface layer.

The wall shown in Figure 1 comprises four sides W joined together at their corners by blind rivets R. Each side is a vertical 1 or horizontal side wall 2 joined together at contacting corners. Vertical struts 3 are present within the frame together with a horizontal element 4 which is a noggin. The wall is made up of a number of panels made as described below. Each panel has an outer perimeter wall made up of sides each of which is a length of thin sheet steel cold formed into channel section which can be cut to length accurately on site using known cutting equipment. Because the steel is cold formed the wall thickness is about 1.2mm. This wall contains electrical fittings 5 in individual panels, in the usual way.

Figures 2 and 3 show one method of forming a panel having an inner lining. The rectangular panel frame is laid cavity side face down on a suitable substrate S. A breathable membrane 11 is applied to the edges by a tape 12 over the open space.

A mesh 10 is then laid over and held in place by ballistic nails 13. Side walls 14 are held to and above the perimeter of the frame by bolts or magnets 15. The walls 14 define a boundary or dam, to prevent the escape of the next applied self-levelling self-setting screed 20. The walls 14 are fixed to a height appropriate to the intended infill. A self-levelling screed 20 is then poured or pumped into the dam, ideally with vibration to de-aerate the composition as it sets. Because the composition is self-levelling the operator does not require a high level of skill. Once the screed is self-supporting, i.e. cured or part cured, the formed panel may be given a surface finish and may be raised to the vertical for storage during which the set composition will reach full cure. The dam wall 14 is then removed.

In the embodiment of Figure 4, the dam 14a is a preformed mould having an inlet 21 and placed on a table T. The frame is laid cavity side lowermost on the walls 14a, the membrane and mesh 10 and any wall components having been fixed to the mesh earlier. A self-setting slurry is pumped via the inlet 21 into the dam 14a. When that has set to provide a panel the panel is raised vertical. It is then stored until the composition has reached full cure.

In a variation a block of anhydrite or cement based composition is located within the dam wall 14 or 14a, and the screed or slurry supplied to lock the block into the formed layer.

The invention is not limited to the embodiments shown. Extra layers may be present. The cavity of the frame may contain heat and/or sound insulation material. The panel may be used to form a vertical wall, ceiling or floor.

The invention offers the following advantages:

- a panel-based method of modular construction which facilitates the efficient manufacture, handling, storage, transport and site erection of building modules;
- a low cost jointless wall finish which is flat and true and does not require skilled labour to produce. (A two man crew can place 1500 sq. metres of self-levelling screed in the frames in an eight hour shift;)
- a method of forming, assembling and applying dry accurate finishes to the cold formed steel frame which is a very rapid and flexible operation. The production process only requires simple, inexpensive tools, jigs and standard handling equipment;
- the spacing of the studs in a wall is not determined by standard plasterboard widths, which permits wider spacings between studs (which may reduce the requirement for steel);
- the materials used and the production process are inherently suited to efficient 'green' disassembly and recycling processes (i.e. low "end of life" costs);
- By selecting the ingredients of the self setting self levelling composition the set layer can have a higher compressive and tensile strength than plasterboard and improved insulation for sound and heat.

CLAIMS

1. A wall panel comprising a frame formed of interconnected structural cold formed metal members, a mesh secured to one face of the frame, on top of which is a surface layer of set self levelled hydraulic material, at least part of which was formed in situ.
2. A panel according to Claim 1, wherein the cold formed metal members are of channel section.
3. A panel according to Claim 1 or 2, wherein the hydraulic material is an anhydrite or gypsum or cement based self levelled composition.
4. A panel according to any preceding Claim, wherein the layer includes preformed portions which are secured in place using set material.
5. A panel according to any preceding Claim, wherein the mesh is secured to the frame using ballistic bolts or like securing means.
6. A panel according to any preceding Claim, including a breather membrane interposed between the frame and the mesh.
7. A building wall comprising an outer skin and an inner skin, the inner skin comprising a plurality of panels according to any one of Claims 1 to 6.
8. A method of making a building wall panel, the method comprising:

- forming a frame comprising interconnected elongate structural cold formed metal members;
- lying the frame on its face;
- securing a mesh to the upper face of the frame;
- applying fittings at the intended locations to the mesh upper face of the frame;
- forming a vertical boundary about the perimeter of the frame;
- supplying a self-setting self levelling composition within the boundary and allowing or causing it to set; and
- removing the boundary.

9. A method of making a building wall panel, the method comprising:

- forming a frame comprising interconnected structural cold formed metal members;
- applying a mesh to the lower surface of the frame;
- applying fittings at the intended locations to the mesh;
- locating the frame with the mesh lowermost over a substrate and within a boundary wall;
- pumping a self-setting self levelling composition between the substrate and the mesh within the boundary wall;
- allowing composition to set; and
- uprighting the frame.

10. A method according to Claim 8 or 9, including the step of locating a preformed body within the boundary or within the frame as appropriate and

then adding the self-setting self levelling composition to secure the body in place and to form the layer incorporating that body.



Application No: GB 0327516.1
Claims searched: 1 - 10

Examiner: J D Cantrell
Date of search: 2 February 2004

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-3, 7	GB 2229465 A PRITCHARD (note Cl 1 "rolled and bent" & see Figures)

Categories:

- | | |
|---|--|
| X Document indicating lack of novelty or inventive step | A Document indicating technological background and/or state of the art. |
| Y Document indicating lack of inventive step if combined with one or more other documents of same category. | P Document published on or after the declared priority date but before the filing date of this invention. |
| & Member of the same patent family | E Patent document published on or after, but with priority date earlier than, the filing date of this application. |

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^W:

E1D : DCF

Worldwide search of patent documents classified in the following areas of the IPC⁷:

E04C

The following online and other databases have been used in the preparation of this search report:

EPODOC, PAJ, WPI